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09/784,952	02/16/2001	Toshinori Ono	29287/117	4195

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EXAMINER

UHLIR, NIKOLAS J

ART UNIT

PAPER NUMBER

1773

DATE MAILED: 12/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/784,952

Applicant(s)

ONO ET AL.

Examiner

Nikolas J. Uhlir

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 October 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) 3-7 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-2, 8-11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 1.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Priority

Election/Restrictions

1. Applicant's election of claims 1-2 and 8 in Paper No. 4 is acknowledged.

Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1 and 2 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. In the instant claim 1, applicant requires "the proportion of functional groups per 1-carbon atoms in a diamond like..." It is unclear to the examiner what "per 1-carbon atoms" means. Is the applicant trying to claim a proportion of functional groups per "single" carbon atom? Further, Claim 1 requires "at least one of the -COOH, -C=O, -CNH₂ as the functional group, for protecting the magnetic film exceeds 20%." It is unclear to the examiner if the applicant is requiring that at least one of -COOH, -C=O, or

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-CNH₂ have to be present in an amount greater than 20% or if the applicant is requiring that any combination of these functional groups may be present, with the total amount of functional groups being >20%. Clarification is required.

Claim Rejections - 35 USC § 103

6. Claims 1-2 and 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yokosawa et al. (US6001479) in view of Ruhe Et al. (Journal of Applied Polymer Science, Vol. 53, 1994 pp 825-836).

7. With respect to the limitations of claim 1, wherein the applicant requires a magnetic recording medium characterized in that the magnetic recording medium has a magnetic film on a non-magnetic substrate and a diamond like carbon protective layer over the magnetic layer, wherein the diamond like carbon protective layer contains at least 1 functional group selected from the group of COOH, -C=O, and CNH₂, wherein the amount of the functional groups based on 1-carbon atoms exceeds 20%.

8. For the purpose of this examination, the examiner has interpreted the transitional phrase "characterized in that" to be open language, thus allowing other layers aside from those directly specified by claim 1 to be present. Further, the examiner has interpreted "the proportion of functional groups per 1-carbon atoms... at least one of the -COOH, -C=O, and CNH₂ as the functional group, for protecting the magnetic film, exceeds 20%" as meaning that any combination of functional groups is acceptable, as long as one of -COOH, -C=O, or CNH₂ is present, and the proportion of functional groups based on 100 carbon atoms exceeds 20%. This interpretation of claim 1 is supported by page 5, lines 1-7 of the instant specification.

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9. With respect to the limitations of claim 1, Yokosawa et al. teaches a magnetic recording medium comprising a non-magnetic substrate, a magnetic layer (equivalent to applicants claimed magnetic film on a non-magnetic substrate by intercalating at least an underlayer), a protective layer, and a lubricating layer (column 3, lines 40-50). The protective layer is formed of diamond like carbon (DLC), and the lubricating layer comprises a perfluoropolyether lubricant having a polar terminal group and a hydrocarbon lubricant (column 5, lines 30-67 and column 8, example 2). Further, Yokosawa et al. teaches that the terminal groups on the perfluoropolyether lubricant and the functional groups on the DLC surface affect how the lubricant is adhered. Certain terminal groups on the lubricant will chemically adsorb functional groups on such as COOH (carboxyl group) or OH (hydroxyl group) on the DLC surface, whereas certain terminal groups on the lubricant will not chemically adsorb these functional groups, thus resulting in the lubricant being physically adsorbed onto the surface (column 10, lines 1-13).
10. Yokosawa et al. does not teach a DLC film that has a proportion of functional groups per 1-carbon atoms that is greater than 20%, wherein the functional groups are selected from COOH, -C=O, and -CNH₂, as required by claim 1.
11. However, Ruhe et al. teaches that the surface chemistry of a solid surface such as the surface of diamond like carbon impacts the attachment mechanisms of a lubricant film, specifically lubricants such as perfluoropolyethers (p 828, left column 1st paragraph, and page 829, right column 1st paragraph). In particular, Ruhe et al. teaches that lubricant films that are attached to surfaces that have a large number of surface

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reactive groups, such as a DLC coating having large numbers of -COOH, CO and C-OH groups on its surface contain more chemisorbed polymer, whereas films which are attached to surfaces with few surface reactive groups (such as cleaved graphite) are more physisorbed (p 828, right column table, p 833, right column 1st paragraph, p 834, left column paragraph 2). Chemisorbed films are more strongly adhered to the substrate surface than physisorbed films, and are not easily removed from the substrate (page 835, conclusion). Ruhe teaches that the amount of functional groups on the surface of the carbon film can be controlled by carefully controlling the parameters of the sputtering process utilized to form the DLC film (page 828, right column). Thus, the examiner takes the position that the number of functional groups on the surface of a diamond like carbon film that is coated with a perfluoropolyether lubricant is a results effective variable.

12. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to change the number and type of functional groups on the surface of the DLC film taught by Yokosawa et al., in order to optimize the adhesion of a specific lubricant to the surface of the DLC film.

13. One would have been motivated to change the number of functional groups on the surface of the DLC film taught by Yokosawa et al. due to the teaching in Ruhe et al. that adhesion of a perfluoropolyether lubricant to the surface of a DLC film is increased when the DLC film contains a large number of functional groups, due to the increased likelihood that the lubricant will be chemisorbed onto the surface of the DLC film. One would have been motivated to change the functional groups on the surface of the DLC

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film taught by Yokosawa et al. due to the teaching in Yokosawa et al. that the terminal groups of perfluoropolyethers will only chemically adsorb certain functional groups on the surface of a DLC film, and the teaching in Ruhe et al. that perfluoropolyethers which are chemically adsorbed (chemisorbed) are more strongly adhered to the surface of a DLC film than those which are physically adsorbed (Physisorbed). One would expect greater longevity of a lubricant which is more strongly adhered to a surface than one which is physically adsorbed.

14. Regarding the limitations of claim 2, wherein the applicant requires a lubricating layer formed of a perfluoropolyether having at least one functional group on the protective layer. This limitation is met as set forth above for claim 1.

15. Regarding the limitations of claims 9 and 10, wherein the applicant requires substantially the same limitations as claims 1 and 2, with the only exception being that claim 9 requires the proportion of functional groups to be based on 100 carbon atoms instead of 1-carbon atoms. These limitations are met as set forth above for claims 1 and 2.

16. Claims 8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yokosawa et al. as modified by Ruhe et al. as applied to claims 1 and 9 above, and further in view of Hosoe et al. (US5759681).

17. Yokosawa et al. as modified by Ruhe et al. does not teach a driving part for a magnetic recording medium, a magnetic head having a recording part and a reproducing part, and a recovery-reproducing signal processing part for giving and

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receiving signals to the magnetic head, and a magnetoresistive head as the reproducing part of the magnetic head.

18. However, Hosoe et al. teaches a well known magnetic recording system for a multilayer magnetic medium, wherein the recording system comprises a drive section (equivalent to applicants driving part), a magnetic head having separate read/write sections (equivalent to applicants claimed magnetic head having a recording part and a reproducing part), wherein the reproducing part is magneto resistive, and read/write signal processing means (equivalent to applicants claimed signal processing part for sending and receiving signals to the magnetic head) (column 10, lines 40-65).

19. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the magnetic recording apparatus taught by Hosoe et al. with the magnetic recording medium taught by Yokosawa et al. as modified by Ruhe et al.

20. One would have been motivated to do so due to the teaching in Hosoe et al that a magnetic recording apparatus having the required structure of claims 8 and 11 are well known as suitable for use with multilayer magnetic recording media (such as the media taught by Yokosawa et al. as modified by Ruhe et al.).

Conclusion

21. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hayashi et al. (US5637373) is cited as pertinent prior art. Hayashi et al. teaches the addition of group IV elements such as N into a DLC protective film in order to reduce the internal stress of the DLC film and increase its

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adhesion to a substrate. Applicant should particularly note that Hayashi et al. teaches the addition of nitrogen to the DLC film by incorporating a reactive gas such as ammonia into the deposition chamber when the DLC film is being processed (column 5, lines 45+). Such a process would form -CNH_2 groups on the surface of the DLC film.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhler whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.



nju
November 22, 2002



STEVAN A. RESAN
PRIMARY EXAMINER

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